From the Editor

Flexible-Pipe Concerns Drive Home the Need for Tank-Owner Vigilance

It probably comes as no surprise to any of our readers that piping and associated sumps have been and continue to be the sticklers in our quest to achieve UST-system integrity nirvana. Over the past year, several states, particularly Mississippi and Florida, have reported that certain types of flexible-piping systems have been failing and with increasing frequency – and we don't hear that about tanks.

John Mason, U.S. EPA Region 4 UST Program Manager, says he has received reports from several states regarding several different generations of polyethylene flexible piping exhibiting unusual physical changes. "Some of the changes appear to be an elongation of the pipe resulting in torn containment sump boots, compressed test boots, contorted flex connectors, and splitting of the pipe as it grows over metal fittings. There are other reports where the outer layer has wrinkled, softened, and split," says Mason.

"The reports described changes that occurred sometimes within weeks, or even days of installation," notes Mason. "There seem to be more and more reported incidents as inspectors and owner/operators become more familiar with what to look for in the piping and dispenser sumps. The majority of the piping incidents have been detected in time, and within secondary containment; however, there have been some catastrophic failures resulting in releases to the environment of several thousand gallons of product."

Now I know there has been some discussion about the definition of "failure." And the federal UST rule does not specifically define what constitutes a failure. So, for the purpose of this discussion, let's say that a product that fails to perform according to reasonable customer expectations is a failure. I don't think there is a regulator (or tank owner) out there who reasonably expects that as a normal" occurrence, flex pipe will swell and tear out penetration fittings, thus destroying the integrity of the secondary containment system. Fortunately, most of the flex-pipe failures that have been reported recently have not resulted in releases into the environment.

Although a thorough assessment of the facts has not yet been made, the New England Interstate Water Pollution Control Commission, the organization that produces this publication, feels it is important that we give our readers a heads-up on this issue, so that steps can be taken to avoid any potential releases to the environment and threats to human health and safety. It is likely that most systems will not have a problem, but vigilance is always well advised with any UST system.

Failure Modes

Tom Schruben, an independent risk management consultant who has reviewed reports of close to 200 failures in double-walled flexible pipe systems in 11 states, says that there are two distinct failure modes, which sometimes operate in tandem:

- The most common failure mode is one where the outer layers of the primary pi pe soften, swell, and split. The pipe often feels sticky and spongy. The swelling can cause the pipe to grow several inches in length. This growth sometimes tears the secondary containment boot at the sump wall. Swelling can also seal off the interstice of the coaxial pipe against the coupling ferrule, masking a leak in the primary pipe.

- The second mode of failure involves the end fittings of the primary pipe. The swaged fittings sometimes split or loosen, allowing the pipe to slip off of the end fitting. This can happen at either end of the pipe run.

"These failures are not limited to a particular manufacturer or even a particular generation of pipe," says John Mason. He explains that the total amount of pipe in the ground of each brand is not known, so it is impossible at

this point to determine if a particular brand of pipe is failing more frequently than another. The amount of flexible piping being used in new installations has increased by 50 percent since 1995. Mason says it is not clear whether the failures are the result of installation error, shipping damage, poor quality control, design flaws, fuel incompatibility, or poor maintenance and monitoring of sumps – or a combination of these things.

Preemptive Actions

One aspect of the failures that is clear to regulators and owners alike is that the piping failures are too often compounded by leaks in sumps. Not only do sump leaks allow the petroleum to discharge to the environment, they can also defeat the release-detection system because the product does not fill the sump to the trip level of the liquid sensor.

UST owners, state regulators, and state fund administrators are approaching this problem in different ways around the country. Several states are looking into the problem to determine what actions will be appropriate. Pipe vendors are working with the states and tank owners to try to resolve these issues.

One conclusion is clear, however – both UST regulators and tank owners need to increase their vigilance for potential failures of flexible piping, and they should be ready to take swift action when failed (or failing) piping is discovered. The good news is that many of the piping abnormalities are easily visible if you know what to look for and where to look. Here are some preemptive actions that we have gleaned from discussions with regulators, consultants, and flex-pipe vendors.

- **Inspect the piping sumps for any of the following signs of compromised integrity:**

  - ✓ Sticky and deformed pipe in the sumps and cracked or loose end fittings
  - ✓ Misaligned piping tees, ells, and riser pipes
  - ✓ Pipe that is bent at an unusual angle where it is terminated into the submersible pump housing or metallic fittings underneath the dispensers
  - ✓ Pinched, buckled, or elongated piping
  - ✓ Any signs of swelling or growth of the secondary jacket of coaxial piping over the coupling ferrules
  - ✓ Compression, swelling, or distortion of the rubber boots that may be installed on the pipe in coaxial systems where the metallic fitting is installed at the pipe terminations
  - ✓ Stretching or tearing of the rubber boots that are installed in the walls of the containment sump, or boot clamps that are out of place
  - ✓ A visible crack or leaking fuel at the swaged area of the end fitting
  - ✓ Fractures or cracks in the outer layers of the primary pipe

- **Test the secondary containment and release-detection system to confirm that it is working properly.** As with all pressurized piping, release detection is critical to preventing releases to the environment. Properly functioning secondary containment and rapid response to release alarms have kept a number of flex-piping failures from becoming major releases to the environment.

  - ✓ Check that sumps are liquid-tight and that sensors and alarms are working.
  - ✓ Consider adding additional, redundant piping release-detection systems to minimize any release that might occur from a failure of the primary pipe. There are a variety of release-detection systems that can be used

in combination with pressurized piping, including liquid sensors in the sumps, mechanical line-leak detectors, or electrical interlocks from the leak-detection system to the pumps.

- **Do not allow any fuel to remain in the secondary containment system for any length of time.** For purposes of this discussion, secondary containment refers to the outermost jacket of the coaxial pipe, secondary containment conduit pipe, sumps, and the various boots. What is not clear to investigators is exactly how long an exposure to product constitutes *too* long.

- **If you find compromised flexible piping, take it out of service immediately. Investigate and preserve the evidence of the failure so that an effective examination of the failure can be made and we all can gain a better understanding of the causes of the failures.** Have an independent expert at the site when removing failed equipment or investigating suspicious releases. Many state inspectors, insurance adjusters, and installation experts, such as installers, have the experience and the qualifications for this task. Notify the manufacturer and other parties concerned and work closely with them to investigate the causes of the failure. The manufacturers and marketers of flexible piping need to be involved in the investigation if the owner intends to make a warranty claim. Many owners are preserving samples of failed piping for independent testing. Document the condition of the system as it is being uncovered and removed with photographs.

Vigilance, Vigilance, Vigilance!

The bright spot in this flexible-pipe situation is that many of the failures have been discovered and caught by vigilant UST owners and regulators before they resulted in releases to the environment. With further analysis of these failures and improved communication, we can gain a clearer understanding of the root causes of these failures and manage the risks.

EPA's Office of Underground Storage Tanks (OUST) has work underway to collect quality data to determine the cause, scope, and magnitude of the problems described above. OUST intends to work with Underwriters Laboratory (UL), the manufacturers of flexible pipe systems, the states, and EPA's Office of Research and Development to gather needed information on flexible pipe issues.